CHAPTER 7.8
CHEMICAL HANDLING AND SLUDGE MANAGEMENT

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CHAPTER 7.8 CHEMICAL HANDLING AND SLUDGE MANAGEMENT

7.8-1. GENERAL. Chemical handling and sludge management systems typically consist of mixing and storage systems for the chemicals, pumps, control systems, and piping.

7.8-2. PRODUCTS.

a. Chemicals. Treatment chemicals are one of the greatest hazards associated with a ground water treatment facility. Material safety data sheets for each chemical must be available at the site. The construction of suitable chemical handling systems is critical to the safety of personnel during operation. Material requirements for pumps, piping and storage systems must be carefully checked with the specifications. In addition to the hazards associated with the chemicals themselves, care must be exercised to prevent mixing of chemicals due to chemical reactions which may occur.

b. Chemical Metering Pumps. Chemical metering pumps should be supplied with adequate turndown capacity to allow for varying flow conditions. Capacity and materials of construction for pump internals are critical to pump performance. Ensure that the specification has been closely followed with respect to required internal components.

c. Chemical Feed Systems. To the greatest extent possible, the chemical feed system should be provided as a system with all components coming from the same manufacturer. Each chemical has unique equipment requirements with regard to sizing, materials of construction, control, etc. Ensure that the specifications have been closely followed with respect to using a single vendor.

d. Sludge Management. Sludge thickeners are typically used for storage and thickening of sludge. Sludge thickeners are normally fed using positive displacement diaphragm pumps or progressive cavity pumps. Sludge generated from biological or metals precipitation treatment processes requires some type of collection, pumping, thickening/conditioning and dewatering. The goal of the sludge management system is to reduce the sludge volume as much as possible to reduce disposal costs. This is accomplished by dewatering the sludge.

7.8-3. EXECUTION.

a. Chemical Handling.

(1) Safety. Operation of the chemical feed and storage system is potentially the most hazardous activity for the plant operator. It is imperative that all safety precautions of the material safety data sheets for each chemical be closely followed. Personnel should wear protective equipment and never work on chemical tanks and pipes alone. Water should never be added to concentrated acids or bases because violent reactions may occur. However, concentrated acids or bases may be added cautiously to water.

(2) Acid. Refer to the specifications for installation and materials requirements. Acid piping requires special attention for safety reasons. Ensure the contractor takes appropriate measures to

address the expansion and contraction that occurs over normal temperature variations.

(3) Caustic. When 50 percent sodium hydroxide (caustic) is utilized in northern climates, storage of the 50 percent caustic is a concern due to potential freezing at relatively high temperatures (13 degrees C (55 degrees F)). The potential for freezing at these temperatures will necessitate providing storage within the process area, or provisions for heat tracing of the piping and heating of the tank contents.

(4) Lime. Lime is used to enhance the conditioning of sludge in the sludge dewatering process and may also be used for pH elevation. Hydrated lime is provided in a powder form, while quicklime is usually provided in granular or nugget form. Quicklime is normally used only in very large applications. When quicklime is used, the grit produced during formation of lime slurry (slaking) must be disposed of. Hydrated lime does not produce a grit requiring disposal. Depending upon the size of the application and the lime requirements, the lime may be stored in a silo or handled using bags. If a lime silo is required, the plans and specifications should be carefully followed. If a carbon steel slurry mix tank is provided, ensure that the interior of the tank is coated to prevent rusting.

(5) Polymer. Polymer is utilized to assist in the agglomerization of particles in solution and to reduce solids loading on downstream processes. Polymer may come in powder or liquid (neat) form. When polymer is mixed to the application strength (typically one percent), the solution usually has a limited shelf life. When spilled, polymers will present a slip hazard.

(6) Oxidants. As previously discussed, oxidants such as hydrogen peroxide are used in a variety of applications within a ground water treatment facility. Oxidants are very hazardous. Verify that the procedures in the specifications regarding safe handling and storage are followed closely.

(7) Chemical Piping. As a safety consideration, chemical piping should not be run overhead without using a tray guard or other method to capture the chemical in the event of a pipe rupture. If this is not specified, contact the designer.

(8) Chemical Tank Requirements. Secondary containment is typically provided around the chemical storage tanks in the event of spills or a catastrophic failure of the primary storage tank. Tank labels and material safety data sheets should be in place prior to filling the tanks.

(9) Controls. The control system may be manual, on/off, or proportional based on liquid level, flow, pH, ORP or other process measurement. If tied to a supervision, control and data acquisition (SCADA) system, ensure compliance with the provisions in the specifications.

b. Sludge Management.

(1) Sludge Collection. Sludge accumulates in the bottom of biological and metals precipitation treatment processes and is periodically pumped to a sludge thickening and storage tank. The design of the system is based upon a predicted sludge generation rate. However, it is ultimately up to the contractor/operator of the facility, based upon the sludge accumulation and treatment

efficiency, to determine when and how often to pump sludge from the treatment system. Typically, sludge sampling ports are provided on the equipment to assist operators with the sludge pumping determination.

(2) Sludge Pumping. Sludge pumps are capable of pumping fluids with high solids content. Sludge pumps are typically of the pneumatically operated diaphragm type or progressive cavity type. Ensure that appropriate air quality (see manufacturers recommendations) is used to operate diaphragm pumps.

(3) Sludge Thickening/Conditioning. Sludge thickening on most HTRW projects is usually a batch process. During the thickening and conditioning, lime and/or polymer is added to enhance sludge dewatering. The supernatant (water) from the sludge is usually returned to the front of the treatment plant for further treatment. The contractor is required to optimize sludge thickening/conditioning to maximize the solids content and minimize the volume of sludge requiring dewatering. Efficient use of chemicals should also be considered. Verify that access has been provided to remove the internal mechanism of the sludge thickener for maintenance activities. Contact the design district if adequate access has not been provided.

(4) Sludge Dewatering. The contractor is responsible for providing and operating some type of sludge dewatering system. This is often a container where the sludge has time to settle further followed by a plate and frame filter press to dewater the sludge.

(5) Sludge Dewatering Equipment. Sludge filter presses mechanically "squeeze" the water from the sludge. Housekeeping is normally a concern when operating a filter press. Hose bibs (spigots) should be provided near the sludge filter press to assist in general cleanup. Verify that sufficient thought has been given to the placement of the roll-off containers to be used to collect the dewatered sludge. This is important to prevent spillage/over splash of contaminated sludge material on to the ground. If not, contact the design district. If a sludge dryer is utilized to further reduce the water content in the sludge, be aware that the dryer tends to produce large amounts of dust.

(6) Sludge Disposal. Options for off-site disposal of sludge should be determined well in advance of the time for disposal. The sludge may be classified as a hazardous waste. A written agreement with an EPA/state approved disposal facility may be required. Manifesting may also be required. Refer to EP 200-1-2 for additional information on manifesting.